PATENT SPECIFICATION

Convention Date (Germany): Sept. 1, 1930.

376,974

Application Date (in United Kingdom): Aug. 5, 1931. No. 22,168/31.

Complete Accepted: July 21, 1932.

COMPLETE SPECIFICATION.

Improvements in and relating to Combustion Chambers.

We, AKTIENGESELLSCHAFT BROWN, BOVERI & CIE., of Baden, Switzerland, a Swiss Company, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

Combustion chambers for gas turbines or steam generators with pressure firing require not only to be constructed for high internal pressures, that is to say pressure-resisting, but must in many cases be provided with cooling jackets which withstand high pressures, as water is used for the cooling medium, which evaporates and is used to contribute to the production of power. The pressure to which the cooling medium is subjected may then be considerably higher than the pressure in the combustion chamber, and the diameter of the cooling jacket will be considerably greater than the diameter of the combustion chamber which is itself of considerable dimensions. Both circumstances entail the provision of very thick walls for the combustion chamber and the cooling jacket, that is to say heavy and costly bodies. For this reason it has already been proposed to use instead of the cooling jacket which surrounds the chamber from the outside tubes mounted inside the pressure-resisting wall of the combustion chamber and in this way to protect the wall of the chamber from excessive heating. As the tubes are of relatively small diameter, the wall thicknesses are small even for very high pressures of the cooling liquid, so that the constructional weight of the cooled combustion chamber is considerably smaller than is the case with chambers with an external jacket.

It has been proposed in steam boilers of normal construction to surround the combustion chamber with an integral water-cooled wall formed by welding spacing plates between a series of vertical parallel tubes.

Such a construction is suitable for steam boilers the combustion chambers of which are subjected to the pressures normally found therein.

In order to cope with the high pressures associated with the combustion chambers of the type contemplated by the present invention however a close spacing of the tubes is necessary and the spacing plates must be replaced by the welding, or welding and intermediate wire, necessary to connect the tubes.

The present invention consists in this, that the pressure-resisting combustion chamber is itself formed by the tubes through which the cooling medium flows, the said tubes being closely spaced and welded together by solid welding or a weld including a wire in such a manner that a continuous fluid-tight pressure-resisting wall results.

In Figs. 1 to 10 of the accompanying drawing various constructional examples are shown. In general ordinary cylindrical tubes will be used for the construction of the main walls of the chamber. As shown in Fig. 1 the tubes are placed close together. The gap can then be directly bridged by welding or the gap is partially filled by an insertion, for instance by a round wire as shown at 1, or by a profiled wire (Fig. 2) as shown at 2 in Fig. 3. The combustion chamber wall may be formed by a helically wound tube (Fig. 4) the longitudinal joints of which are welded or it may consist of straight pieces of tubing which extend parallel to the axis of the chamber (Figs. 5 and 6). In the case of the tubular helix the tangential stresses in the wall are taken up by the tubes themselves. The welding serves primarily for the purpose of forming a tight joint. The forces acting on the bottom and the cover of the chamber are on the other hand taken up by tension bolts 3 (Fig. 4) which are at the same time used as bolts for bolting up the bottom 4 or the cover. To the tubular helix a suitable flange 5 is welded. The lagging at 6 provides for the tension bolt 3 having approximately the same temperature as the tubes; if necessary the bolts may be bored or be surrounded by a tube through which liquid having the same temperature as that in the tubes is conveyed.

When the tubes are placed parallel to

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the chamber axis as in Figs. 5 and 6 the tangential forces acting on the wall are taken up substantially by a cylinder 7 against which the tubes rest closely. Before being welded at 8 the tubes are attached to the wall at several places, for instance at 9, to ensure their bearing against the wall. This wall resists the forces due to the pressure acting on the bottom and the cover. As these forces require only half as much cross-section as the tangential tensional stresses in a cylinder wall, which latter however are in this case at least in part taken up by the welding, the cylinder wall with the tubes can be made much lighter than an ordinary cylindrical chamber wall. In place of the cylinder wall tension bolts may in this case also be used for resisting the forces acting on the bottom and cover, and the tangential strains may be resisted for instance by individual strong rings.

In place of the cylindrical tubes, tubes having other sectional profiles may be employed. In order to increase the width of the bridging parts 10 (Fig. 5) in the flanges between each two tubes and to reduce the number of tubes and welding seams, the cylindrical tubes may be pressed to an oval shape as shown in Figs. 7 and 8. They retain their cylindrical shape only inside the flanges (at 11, Fig. 8). The tubes may also be trapezoidal (Fig. 9) or rectangular (Fig. 10) for facilitating the building up of a cylinder. These cross-sections are well rounded or inclined at the corners for providing space for sufficient quantities of welding material.

As it is in most cases desirable that the internal cylindrical surface shall be smooth, the welds are subsequently ground with an emery wheel.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A high pressure combustion chamber for gas turbines, steam generators or the like, which is cooled by a cooling medium which is under higher pressure, characterised by the feature that the pressure-resisting combustion chamber wall is formed by closely spaced tubes which carry the cooling medium and are welded together directly to form a continuous gastight enclosure.

2. A high pressure combustion chamber for gas turbines, steam generators or the like, which is cooled by a cooling medium which is under higher pressure, characterised by the feature that the pressure-resisting combustion chamber wall is formed by closely spaced tubes which are welded together by joints which include a relatively longitudinally disposed round or profiled wire.

3. A pressure-resisting combustion chamber as claimed in Claim 1 or 2, characterised by the feature that the combustion chamber wall consists of a tubular helix, the longitudinal joints of which are welded.

4. A pressure-resisting combustion chamber as claimed in Claim 1 or 2, characterised by the feature that the combustion chamber wall is composed of tubes extending parallel to the cylinder axis.

5. A pressure-resisting combustion chamber as claimed in any of Claims 1 to 4, characterised by the feature that the forces acting on the bottom and cover of the combustion chamber are resisted by tension bolts extending over the length of the combustion chamber wall.

6. A pressure-resisting combustion chamber wall, as claimed in Claim 1 and any of Claims 3 to 5, characterised by the feature that the tubes are of non-cylindrical shape, for instance of oval, rectangular or trapezoidal shape with considerably rounded corners, for facilitating both the building up of the chamber and the welding together of the tubes.

7. The improved pressure-resisting combustion chamber for gas turbines, steam generators and the like, substantially as hereinbefore described and as illustrated in and by the accompanying drawing.

Dated this 23rd day of July, 1931.

MARKS & CLERK.

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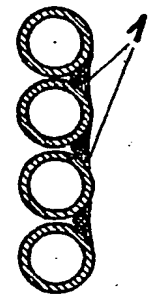

Fig.1

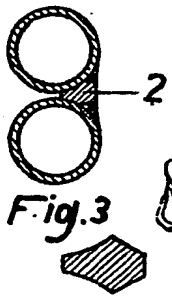

Fig.3

Fig.2

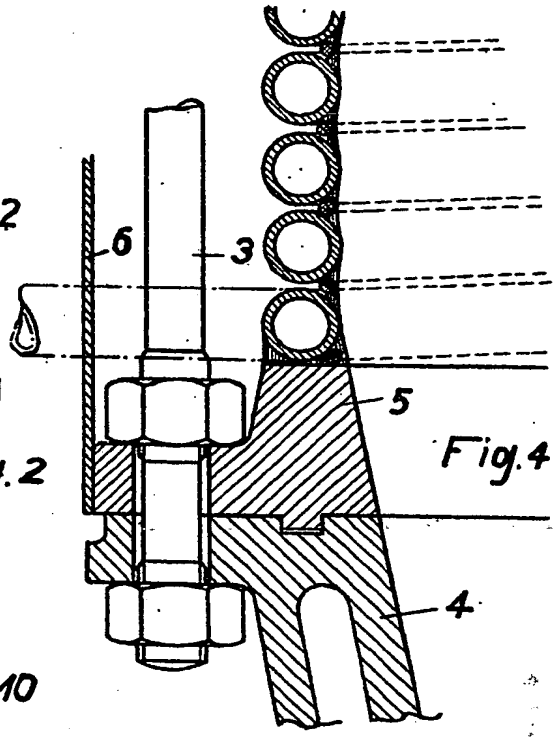

Fig.4

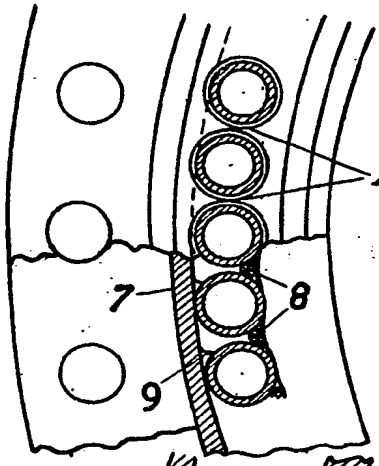

Fig.5

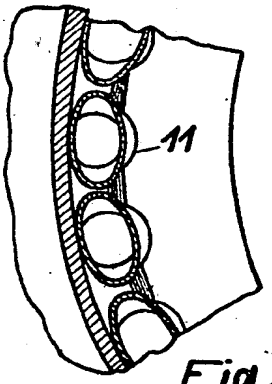

Fig.7

Fig.9

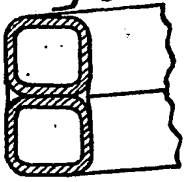

Fig.10

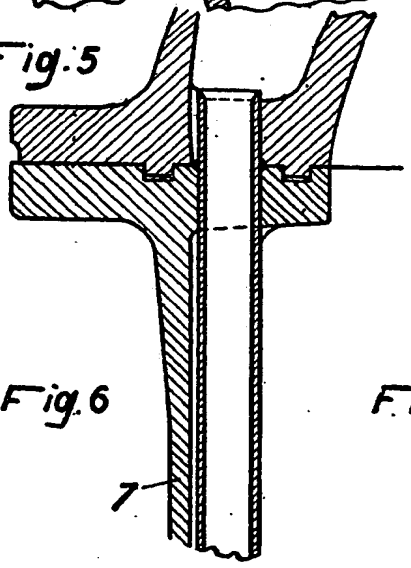

Fig.6

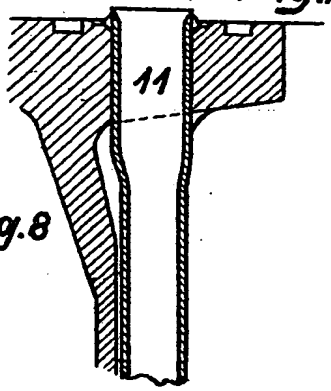

Fig.8

Charles & Read Ltd. Photo Litho.